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THE

MINERALOGICAL MAGAZINE

AND

JOURNAL

OF THE

Mineralogical Society

OF

GREAT BRITAIN & IRELAND,

INSTITUTED 3rd FEBRUARY, 1876.

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1876.

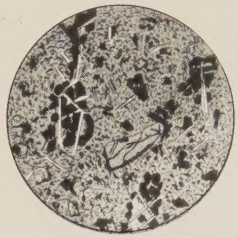

Fig. 1. × 9.

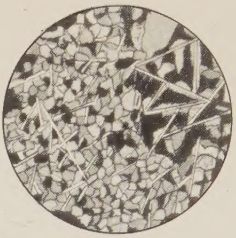

Fig. 2. × 23.

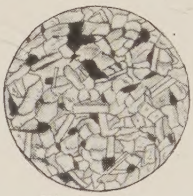

Fig. 3. × 80.

Fig. 5. Nat. Size.

Fig. 10. Nat. Size.

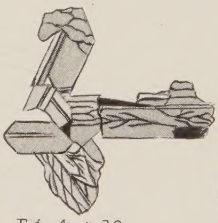

Fig. 4. × 10.

Fig. 6. × 20.

Fig. 11. × 20.

Fig. 7. × 100.

Fig. 12. Nat. Size.

Fig. 8. × 50.

Fig. 13. × 150.

Fig. 9. × 200.

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PROCEEDINGS

OF THE

MINERALOGICAL SOCIETY OF GREAT BRITAIN AND IRELAND.

1876.

Meeting for the formation of the Society held at the Scientific Club, 7, Savile Row, London, February 3, 1876, H. C. Sorby, Esq., F.R.S., in the Chair.

The following Rules were adopted:—

1. That a Society be formed to advance the Study of Mineralogy and Petrology, and that it be called the Mineralogical Society of Great Britain and Ireland.

2. That the Society shall consist of Ordinary Members, Associates, and Corresponding Members.

3. Ordinary Members shall be persons interested either in scientific or economic mineralogy.

4. Associates shall consist of students of mineralogy, miners, and others, who are not fellows of any Chartered Scientific Society.

5. Ordinary Members and Associates shall be proposed by not less than two ordinary members, one of whom must be personally acquainted with the candidate, and they shall be elected by the Council.

6. Mineralogists or others likely to advance the interests of the Society, who do not reside in the United Kingdom, may be elected by the Council as Corresponding Members.

7. Ordinary Members shall pay an entrance fee of £1 1s., and an annual subscription of £1 1s., or may compound for the annual subscription by a payment of £10 10s. No entrance fee shall be required from members joining the Society up to and including the 3rd February, 1876.

8. Composition fees shall be treated as capital, and not as income.

9. Corresponding Members shall pay no subscription or entrance fee. Associates shall pay an annual subscription of 5s., and an entrance fee of 5s.

10. All subscriptions become due on the 1st January in each year, but members and associates elected after the 1st November, shall not be required to pay the subscription for that year.

11. The Society shall be governed by a Council, consisting of a President, two Vice-Presidents, Treasurer, General Secretary, Foreign Secretary, and twelve ordinary members.

12. The President, Vice-Presidents, Treasurer, General Secretary, Foreign Secretary, and four new ordinary members of the Council shall be elected annually, at the Annual Meeting.

13. For the first two years of the existence of the Society four of the ordinary members of the Council shall retire by lot, or otherwise, as the Council itself may determine, but after that period by seniority, and shall not be eligible for re-election until after the expiration of one year.

14. In addition to the above, the Presidents who have passed the chair shall be permanent members of the Council.

15. All ordinary members, whose subscriptions are not in arrear, shall be eligible as office-bearers or members of Council.

16. The Council shall prepare a nomination list previous to each annual general meeting, and the name of any ordinary member shall be added to the list by the General Secretary, on his receiving a requisition to that effect from any two ordinary members.

17. At meetings of the Council five shall be a quorum.

18. The election of all officers and members of council shall be effected by the agency of voting papers, which shall be sent by the General Secretary, at least a month before the election, to every ordinary member, who shall be entitled to substitute the names of any other members for those nominated by the Council to any office. The voting papers shall be examined by the two Auditors appointed at the previous annual meeting, who shall be requested to act as scrutineers.

19. Associates and corresponding members shall not be eligible to hold any office, nor to vote in any election.

20. There shall be two Trustees elected, in whom shall be vested the capital of the Society.

21. Two Auditors shall be elected at the Annual Meeting, whose duty it shall be to audit the accounts of the Society.

22. The Annual Meeting shall be held within the United Kingdom at the time and place decided upon by a majority of votes of ordinary members and associates at the previous annual meeting.

23. General Meetings shall be held from time to time as may be deemed necessary by the Council, or on the requisition of any 20 members.

24. Local Meetings may be held at any time and place, as may be agreed upon by any six members, or associates. Any ordinary member may be appointed as Local Secretary, with the sanction of the General Council. It shall be the duty of the Local Secretaries to transmit a record of the proceedings at the Local Meetings to the General Secretary.

25. Each ordinary member, associate, and corresponding member, shall be entitled to attend all meetings of the society, to introduce friends thereto, and to receive a copy of the Journal of the Society.

26. The Council Report, and a Balance Sheet, previously audited by the auditors elected at the previous annual meeting, shall be issued to every member and associate as early as possible in every year, which report and balance sheet shall be presented for approval at the next annual meeting.

27. A Journal shall be issued, and sent, post free, to every member and associate, containing reports of proceedings at local and other meetings, descriptions of new and rare minerals, notices of new localities or analyses, notes, and queries, &c., &c.

28. A majority of three-fourths of the whole Council shall have power to expel any member or associate, but the person expelled shall have a right of appeal to the next annual meeting. Notice of such an appeal must be sent to the General Secretary, at least six weeks before the meeting, supposing the meeting to be so far distant.

29. The Rules can only be altered by a majority of three-fourths of the members present at an annual meeting. Any member desiring to alter the rules must send a copy of the proposed alterations to the Secretary, at least six weeks before the meeting is held. The Secretary, having received notice of any proposed alteration of the rules, or of an appeal from an expelled member, must give notice of the same to every member, at least one month before the meeting.

30. Members and associates, by paying their first contribution, signify their agreement to the above rules.

After the Rules had been adopted, the following Officers were elected :

PRESIDENT.

H. C. SORBY, Esq., F.R.S., &c., &c.

VICE-PRESIDENTS.

The Rev. Professor Haughton, F.R.S., &c., &c.
Professor M. Forster Heddle, M.D., &c., &c.

COUNCIL.

D. T. Ansted, Esq., F.R.S., &c.
The Rev. T. G. Bonney, M.A., &c.
Professor A. H. Church, M.A., &c.
W. Crookes, Esq., F.R.S., &c.
Fred. Drew, Esq., F.G.S., &c.
Major Duncan, M.A., D.C.L., &c.
Archibald Geikie, Esq., F.R.S., &c.
Captain Marshall Hall, F.G.S., &c.
Professor T. Rupert Jones, F.R.S., &c.
Professor James Nicol, F.R.S.E., &c.
Professor F. W. Rudler, F.G.S., &c.
R. H. Scott, Esq., M.A., F.R.S., &c.

TRUSTEES.

The Right Hon. Lord De Blaquiere, F.R.G.S.
Patrick Dudgeon, Esq., F.R.S.E.

TREASURER.

R. P. Greg, Esq., F.G.S., &c.

GENERAL SECRETARY.

J. H. Collins, Esq., F.G.S.

FOREIGN SECRETARY.

C. Le Neve Foster, Esq., B.A., D.Sc., &c.

LOCAL SECRETARY.

Cornwall—B. Kitto, Esq., F.G.S.

AUDITORS for 1876.

M. Hawkins Johnson, Esq., F.G.S.
B. Kitto, Esq., F.G.S.

A vote of thanks to Mr. Collins for his labors in promoting the establishment of the Society was passed with acclamation.

The meeting concluded with a unanimous vote of thanks to Mr. Sorby for his conduct in the chair.

ORDINARY MEETING

Held at the Rooms of the Royal Society of Literature, Charing Cross, February 4, 1876.

The PRESIDENT in the chair.

Professor M. Forster Heddle, M.D., F.R.S.E., read a paper on "Scottish Rhombohedral Carbonates."

Mr. Sorby exhibited some fine artificial pseudomorphs.

Professor Heddle enunciated the following law of chemical interchange, resulting from his study of pseudomorphs, which he offered in place of Bischoff's law of relative solubility.

"Whenever through true chemical interchange the replacing material has an equivalent volume smaller than that of the material replaced, the resulting solid must be more or less cavernous."

LOCAL MEETING OF THE CORNISH MEMBERS

Held at the Public Rooms, Redruth, on Saturday, July 1st, 1876.

Dr. C. Le Neve Foster, *For. Sec.*, in the chair.

Mr. B. Ki[illegible], F.G.S., was elected Local Secretary for [illegible]well, subject to the approval of the General Council.

The following papers were read:—

1. On a new mineral (Henwoodite) from West Phœnix Mine, by J. H. Collins, F.G.S.; with remarks by Dr. C. Le Neve Foster.

2. On the occurrence of Pyrophillite at Brookwood Mine, and on new mineral localities in Devon and Cornwall, by Dr. C. Le Neve Foster.

3. On the oxide of iron enclosed in calcite and quartz at the Mwyndy Mines, Glamorganshire, by Wm. Vivian.

4. On the occurrence of Pharmacosiderite, Scorodite and Olivenite, in greenstone at Terras Mine, St. Stephens, by J. H. Collins.

Specimens were exhibited in illustration of each of the papers.

Dr. Foster exhibited a new and simple form of blowpipe lamp especially suitable for travellers.

EXCERPT MINUTES OF COUNCIL MEETING

Held at King's College, London, on Friday, August 11th, 1876.

The President in the chair.

Resolved—That the election of Mr. B. Kitto, F.G.S., as Local Secretary for Cornwall, be confirmed.

Resolved—That the following gentlemen having been duly proposed in accordance with Rule V. be elected as Members and Associates, viz:—

MEMBERS.

Dr. Walter Flight, F.C.S., British Museum.
Mr. John Roberts, Symdde Dyllwn Mines, North Wales.
Mr. G. W. Rickard, 4, Broad Sanctuary, Westminster.
Mr. R. J. Jenkinson, F.R.G.S., Keswick, Cumberland.

AS ASSOCIATES.

Mr. John Maynard, East Pool Mines, Redruth.
Mr. P. H. Argall, Cronebane Mines, Ireland.
Mr. J. Talbot Stowell, Tuebrook, Liverpool.

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I.—*Note upon a portion of Basalt from Mid-Atlantic.*

By Marshall Hall, F.G.S.

IN the year 1874 the steamship *Faraday* whilst engaged in grappling for the broken telegraph cable, caught the strong claws of the grapple in a rock, which resisted with the strain of about 27·5 tons, to which any but a rope of marvellously perfect manufacture would have yielded. As it was, the rock gave way, and a lump of black basalt came up weighing 21 lbs. This mass shewed signs of having been torn off. The fragment, and the section made from it for the microscope which accompanies this memorandum, were submitted to Mr. J. Clifton Ward, who has kindly examined the specimen, and drawn up the report enclosed herewith.

I cannot find in any charts indications of the habitual voyage of icebergs so far eastwards in the same latitude as the spot in question, and I have consulted Dr. John Rae as to the question of the rock being from an ice-borne mass He says in reply, that he is not aware of icebergs having been seen about that spot, but that such an occurrence is not impossible. He thinks it more likely that, as I had suggested, the fragment was wrenched off some submarine peak or summit or ridge.

My motive in bringing this to the notice of the members of the Mineralogical Society, is a hope that petrologists may at some

future time be able to apply these notes, and the specimen itself, to a comparison with other northerly basalts. I should be glad if an analysis were made.

Should this foundation of an attempt at providing materials for determining the locality of rocks by microscopical and physical evidence meet with acceptance, I have a few sections of rocks, basalt, porphyry, &c., from the drift by the sea shore a little south of Scarborough, to which the society is welcome, if some member will undertake the description, and give any opinion he may be able to form as to the origin of the fragments.

Additional note by J. Clifton Ward, F.G.S.

The specimen referred to above is a small fragment of black basalt, a portion of a mass weighing 21 lbs., which was dredged from the bottom of the Atlantic from the steamer *Faraday*, in latitude 50° 30′ N., longitude 24° 46′ W., depth 2242 fathoms.

The microscopic examination is necessarily very imperfect, owing to the fact that only one slice can be examined, cut from a very small portion of the rock. Figures 1, 2, 3 and 4 illustrate, I believe, every element in the microscopic rock-structure of the specimen.

The general base is very minutely crystalline, the small needles of plagioclase felspar being, however, less numerous than the grains of augite and olivine, amongst which lie some crystals of magnetite, and a good deal of a very dark brown or black patchy substance, probably an irony product of decomposition.

Scattered sparsely through this base are a few larger crystals, mostly of plagioclase, sometimes occurring in groups, an example of which is given in fig. 4.

Lastly, there are several irregularly shaped and apparently vesicular portions in great part filled with the dark product before mentioned, through which shoot slender plagioclase crystals much longer than those occurring in the surrounding base. A zeolitic mineral apparently fills portions of these vesicles, appearing dark under crossed prisms, but very little of this is seen owing to the thin slice having given way in several cases at the vesicles.

In fig. 1 several of the irregular dark portions are seen, and near the centre of the disc is a fragment of one of the larger plagioclase crystals.

In fig. 2 the base and part of a vesicle are shown more highly magnified, under polarised light. The small, brightly-coloured

portions are grains of augite and olivine; and the white needles, plagioclase felspar, showing longitudinal banding when more highly magnified.

In fig. 3 a portion of the base is shown under a still high power, a kind of granular mosaic with a few scattered acicular prisms and magnetite grains.

Fig. 4 represents the largest group of the porphyritically embedded crystals.

As it is possible that the mass of basalt from which the specimen was chipped had been floated southwards on ice, the microscopic examination of some of the northern basaltic tracts might indicate the parent rock.

II.—*On the occurrence of Celestine in the Keuper marls, and its influence on the composition of plants.*

By W. W. Stoddart, F.C.S., F.G.S., &c.

THE origin of the large deposits of Celestine that abound in certain beds of Triassic age has long been a puzzle to Geologists. At Bristol, Celestine is found only on the lowest beds of the Keuper marls resting on the solid red sandstone rock, and may be collected by the ton.

It occurs in large masses, in veins and in geodes, accompanied by Selenite. In many of the concretions the crystals are long and acicular, radiating from the centre. In other places they seem to be a simple aggregation of crystals so loosely bound together that they may be easily rubbed asunder by the slightest pressure of the fingers. The most beautiful forms, however, are those in the interior of the geodes. They are very large tabular prisms with the angles, edges and planes clearly defined. Their colour is white with a delicate bluish tint, and tolerably transparent, having a diameter frequently as much as an inch.

In the concretions the colour of the Crystals varies from a pure porcellanous white to a light red, caused by the combined Ferric Oxide.

An analysis of some of the concretionary Celestine found at Clifton gave,

Strontium Sulphate	99·13
Barium Sulphate	·46
Calcium Sulphate	·25
Ferric Oxide	·02
Manganesium	trace.
Silica, Alumina, and loss	·14
	100·00

At the well known Aust Cliff, the Keuper marls are well exposed, and form a section many feet thick. Here the deposits of Celestine are comparatively small, while the veins of Gypsum (or Alabaster as it is locally termed) are very large.

An analysis of the Celestine bearing marls at Cotham, chosen from those places where the Celestine was most equally distributed in small crystals, gave

Strontium Sulphate	22·18
Calcium Sulphate	5·23
Ferric Oxide	3·44
Ferric Disulphate	·08
Alumina	16·31
Magnesium Sulphate	3·11
Silica	44·76
Potassium and Sodium Salts..	1·62
Moisture, &c...	3·27
	100·00

The blue colour of the large crystals, before mentioned as found in the geodes is said to be caused by the presence of Ferroso-ferric Phosphate $2\,Fe''_3\,P_2\,O_8\,(Fe''_2\,O_3\,2\,Fe'''\,PO_4)\,16\,H_2\,O$, but I have repeatedly tested them, carefully broken off at some distance from the point of their attachment to the geode, and carefully washed with pure distilled water, without finding any trace of Iron by subsequent analysis, so that if any iron is present it must be very small in quantity.

In most works on Mineralogy, Celestine is said to be found in the Carboniferous Limestone of Bristol. This, strictly speaking, is an error. The limestone itself never yields any at all, but the *fissures* and *crevices* of the Clifton and Durdham Down beds of Limestone are often filled up with Triassic marls and rocks which contain Strontium. Through these water has infiltrated, and holding these minerals in solution has carried them between the beds until stopped by some clay band, and deposited the Celestine at some distance from the surface. This is well seen in what is called "The Great Quarry" where minute crystals of Celestine are collected with others of Fluor Spar.

The same explanation holds good at Aust Cliff. There Celestine is only found in the marls, but is absent from the Carboniferous limestone below, and the Rhætic and Liassic limestone above.

The occurrence of some of our rarest minerals has frequently been detected in the ashes of vegetables. They cannot be essential to the nutrition or growth of the plant, because the same species growing only a few yards distant will often not show the least trace. The subject of the present paper is strong evidence that the roots of a vegetable cannot always restrict their solvent powers to the minerals actually necessary to its welfare, and cannot perfectly separate those that are unnecessary to its existence.

Lithium has been detected in *Gentiana lutea*, *Atropa belladonna*, *Nicotiana tabacum*, *Triticum vulgare* and *Vitis vinifera*. Rubidium in *Beta maritima*, *Quercus robur*, *Thea viridis* and *Coffea arabica*. Manganesium in *Betula alba* and *Fagus sylvatica*.

While making similar experiments on plants growing in the neighbourhood of Bristol with the Spectroscope, I met with many growing on the variegated Keuper marls on the North Eastern side of Cotham Hill in front of Nugent place, which are well known to contain very large masses of Celestine or Sulphate of Strontium. The following genera were analysed, and all shewed abundant evidence of the presence of Strontium, viz:

Taraxacum dens leonis.	Cardamine hirsuta.
Arabis hirsuta.	Poa rigida.
Capsella bursa pastoris.	Senebiera didyma.
Senecio vulgaris.	Cytisus scoparius.

The method used for detecting the metal Strontium in the plants was to well burn them in a muffle furnace, moisten the ash with Hydrochloric acid, and well dry the residue. A platinum wire armed in the usual manner with the ash, placed in a Bunsen flame and viewed by a Spectroscope, showed the Strontium lines of Red Orange and Blue very distinctly.

If the ash be not *strongly* ignited before the addition of Hydrochloric acid, the Sulphate is not sufficiently deoxydised for the Chloride to be fully formed, and then the lines will not be easily visible.

A large number of experiments were made on plants growing on Lias and Rhætic clays in close proximity to the Celestine marls without the detection of a trace of Strontium, but wherever they were gathered on the latter, the spectrum of that metal was plainly apparent.

Garreau (Ann Sc. Nat. 4·13) states "that *young* plants abound "in Alkalies, while *old ones* contain a large quantity of the earthy "and metallic oxides." In the present case, however, so far as Spectroscopic analysis can give quantitative results, the amount of Strontium was the same in both old and young plants. All that were tested were growing on the roadside, but had an opportunity occurred, those growing in the adjoining gardens would doubtlessly have behaved the same.

III.—*Notes on New Minerals and Mineral Localities in Cornwall and Devon.*

By C. Le Neve Foster, B.A., D.Sc.

IN looking over some specimens of chalkosiderite in the possession of Capt. Simmonds, of Liskeard, I noticed a bluish green mineral which was different from the rest, and subsequently on calling the attention of Capt. Hosking of West Phœnix to the mineral I obtained several pieces from him. I tested it before the blowpipe with following results :—

Henwoodite.

Colour. Turquoise blue.
Streak. White with bluish green tinge.
Matrass. Turns brown, gives H_2O, slight decrepitation.
Pt. forceps. Colours flame green ; does not fuse.
C. alone. Does not fuse.
Borax. O.F. green, hot ; blue, cold.
,, R.F. on C. Cu reduced.
Carb. soda on C. ; obtained metallic Cu.
Berzelius' test for P_2O_5. Boric acid bead and Fe on C. obtained round globule of phosphide of iron.
Dissolved in H_2SO_4 added ammonia, blue solution and white flocculent ppte (Al_2O_3).

Filtered, added oxalate of potassium, decided turbidity (Ca O). The mineral is therefore a hydrated phosphate of alumina and copper, with a little lime. Since this examination its composition has been determined by Mr. Collins, who has named it Henwoodite.

Pyrophyllite.

The specimen now exhibited was given to me by the Capt. of the dressing floors at Brookwood mine some months ago ; he assured me that it was obtained from the mine. As far as I am aware this is the first time it has been found in England.

The mineral agrees perfectly with the descriptions I can obtain of Pyrophyllite. The Brookwood mineral has a radiated lamellar structure.

Colour, white; pearly lustre on foliæ. Thin laminæ, flexible but not elastic.

Matrass gives water, and exfoliates.

Pt. forceps. Exfoliates in the most perfect manner, the laminæ separate from one another and open out like a fan.

Nit. of Cobalt gives a very decided blue.

Enysite.

The specimens on the table were obtained from St. Agnes. I found the mineral in one of the caves at the old quay, where it occurs in the form of a bluish green stalagmitic crust, an eighth of an inch thick, and even more.

The water from which the stalagmite was deposited has percolated through the ground on which copper ore used to be stocked previous to shipment.

Matrass gives much water, and on strongly heating a white sublimate near the assay.

Powder heated on C. becomes grey, tried with Nit. Cobalt, *blue.*

On C. alone. Colours flame green and a little blue, turns brown and becomes white at the edges; with cobalt, *blue* at edges.

Pt. forceps colours flame green and a little blue, turns brown, white at edge with strong heat, does not fuse.

Borax bead O.F. Green, *hot;* blue, *cold.*

Mic. salt, O.F. Gives a skeleton of Si O_2 if a fair sized piece is taken; but this disappears entirely after continued heating. Colours as with borax.

On C. with carb. soda gives metallic copper and the mass put upon Ag. with H_2O gives a black spot.

Ammonia throws down Al_2O_3, and the solution becomes blue.

In H Cl. dissolves with effervescence. If concentrated acid is used flocculent silica separates, and after evaporating the greater part of the acid you obtain decided gelatinous silica.

It appears that the mineral is a hydrated compound of alumina and copper, with some sulphates, carbonates, and chlorides.

Mr. Collins has since analysed the mineral and called it Enysite.

The solubility of the Si O_2 in microcosmic salt is peculiar, and when I first tried the reactions with the powdered mineral the presence

of SiO_2 escaped me entirely. Mr. Collins, however, obtained silica in a qualitative wet analysis, and I then tried whether the mineral would gelatinize with HCl., which it did perfectly.

ACTINOLITE AND GARNETS, (S. TERRAS.)

Good specimens of dark green actinolite are found, with green garnets, at South Terras iron mine, near Grampound Road. The iron ore, as might be supposed from the accompanying minerals, is magnetite, as it occurs in masses in connection with an elvan.

I heard of a mineral resembling rutile being found at the mine, but could not obtain a specimen.

ACTINOLITE, GARNET, AND AXINITE, (SOUTH BRENT.)

These minerals occur about ½ mile NE. of South Brent church, in what is marked on the Geological Survey Map as a mass of greenstone. A pit in a field west of the road from South Brent station to Dean furnishes splendid specimens of actinolite, some of the crystals being 3 in. long.

IV.—*Note on New Minerals from West Phœnix Mine, and from St. Agnes.*

By J. H. Collins, F.G.S.

Henwoodite.

THE Mineral from West Phœnix occurs in globular masses of a Turquoise blue or bluish green color upon Limonite. The interior of each spherule is composed of Limonite within which is sometimes a minute quartz crystal; the exterior surface usually shews indistinct crystalline facets. Fragments examined with a hand-lens shew a conchoidal fracture, but a thin section exhibits faint indications of radiated and concentric structure.

The first specimen which came under my notice was given to me by Mr. Simmonds of Liskeard, in October 1875 as a variety of Chalcosiderite or Andrewsite. These minerals had recently been described by Professor N. S. Maskelyne and Dr. Flight, and as there is occasionally a certain resemblance between them and the new mineral, and they all occur together, it was supposed to be the same as one of them.* As the specimen was small I placed it in my cabinet, being unwilling to destroy it by making an analysis.

More recently specimens have been examined by Dr. Le Neve Foster who found in them, by means of the blowpipe, Phosphoric Acid, Copper and Water, with indications of Alumina and Lime. He also noticed that it was infusible and contained no iron, so that it could not be either Andrewsite or Chalcosiderite.

Dr. Foster very kindly supplied me with a few fragments, and of these I have made an analysis with the results given below.

Having carefully picked over the fragments by the aid of a hand-lens, I treated some of them for a short time with warm dilute HCl. having found that acid to have but little effect on the mineral itself. By this treatment I was able to dissolve off most of the obstinately adhering Limonite, and to obtain the mineral in a nearly pure state. I had previously found the H=4-4·5, and the streak white with a bluish green tinge. I now determined the Sp. G. to be 2·67.

* The new mineral is often superficially coated with chalcosiderite.

I found I had ·221 grm. at my disposal, which was gently ignited in a glass tube. It gave off much water and turned dark brownish olive green and lost ·046 grm., indicating 19·5 p.c of water and volatile matter. It was then powdered in an agate mortar and treated with warm HNO_3 in which it dissolved with some difficulty. Phosphoric Acid was then determined by the Molybdate of Ammonia method and found to be ·0343 grm.= 48·2 p.c. The copper was then precipitated in the metallic state and amounted to ·0098 grm=to ·0123 of oxide of copper or 7·0 p.c. The solution, which I had intended to examine further, after separation of the Molybdenum, was unfortunately upset.

I now obtained a further supply from Dr. Foster amounting to ·3562 grm. which yielded.

Lost by ignition	·0609	=17·10 p.c.
$Si O_2$	·0049	= 1·37 ,,
Cu O.	·0253	= 7·10 ,,
$Al_2 O_3$	·0649	=18·24 ,,
$P_2 O_5$	·1743	=48·94 ,,
$Fe_2 O_3$	·0098	= 2·74 ,,
Ca O	·0019	= 0·54 ,,
Loss		3·97 ,,
Total		100·00

The iron alumina and phosphoric acid were determined by Dr. Flight's method.*

The Mineral is therefore essentially a phosphate of Copper and Alumina, with much water, most of which is probably basic as it is not given off at a low temperature. As the quantities operated upon were small and the mineral could not be obtained quite free from foreign admixture, I do not claim a high degree of accuracy for these results—especially as the loss is considerable. The iron, lime, and silica are probably altogether foreign. The composition as thus determined shews that it is most nearly allied to Callainite, Lazulite, Wavellite and Turquoise, but differs greatly from all in the relative proportions of Alumina and Phosphoric Acid.

This difference is so remarkable as to warrant its being considered a new species, and I propose to give it the name of Henwoodite

* Journal of the Chemical Society, July 1875.

in honor of my late distinguished friend, Mr. Wm. Jory Henwood, F.R.S.

In the following table I have tabulated the results of the 1st and 2nd analyses (a and b); the corrected percentages excluding the iron, silica, and lime, the first two of which are certainly and the third probably extraneous (c), the "loss" being distributed; and the theoretical percentages required for the suggested formula, $2Al_2O_3 + 2(\frac{1}{6}CuO\ \frac{5}{6}H_2O)_3\ P_2O_5 + 5H_2O$.

	a. (1st analysis)	b. (2nd analysis)	c. (Corrected)	d. (Theory)
Water	19·50	17·10	18·71	17·42
Copper oxide	7·00	7·10	7·77	7·69
Alumina	..	18·24	19·96	19·93
Phosphoric acid	48·20	48·94	53·56	54·96
Lime	..	0·54	..	..
Silica	..	1·37	..	..
Peroxide of Iron	..	2·74	..	..
Loss	..	3·97	..	..
		100·00	100·00	100·00

Disregarding the ingredients which appear to be extraneous or non-essential, the theoretical per centage composition of the five minerals named may be given tabulated as follows:—

	P_2O_5	Al_2O_3	Cu O.	Mg O.	H_2O.	
Callainite	42·39	30·75	——	——	26·86	=100·00
Lazulite	46·80	34·00	——	13·20	6·00	=100·00
Wavellite	34·40	37·30	——	——	28·30	=100·00
Turquois	32·60	46·90	——	——	20·50	=100·00
Henwoodite	54·96	19·93	7·69	——	17·42	=100·00

It should be mentioned that Turquoise often contains from 3 to 5 p.c. of oxide of copper, but the great difference in the proportions of Phosphoric Acid and Alumina separate the mineral from turquoise.

The formulæ of the same five minerals may be written.

Callainite .. $Al_2O_3\ P_2O_5 + 5H_2O$
Lazulite .. $Al_2O_3\ P_2O_5 + MgH_2O_2$
Wavellite $3Al_2O_3\ 2P_2O_5 + 12H_2O$
Turquoise $2Al_2O_3,\ P_2O_5 + 5H_2O$
Henwoodite $2Al_2O_3\ P_2O_5 + 2(\frac{1}{6}CuO\ \frac{5}{6}H_2O)_3\ P_2O_5 + 5HO$.

The hardness, specific gravity, &c., may be thus given for comparison.

	H.	G.	Form.
Callainite ..	3·5 – 4	2.5 – 2·52	Massive.
Lazulite ..	5 – 6	3·05 – 3·12	Oblique.
Wavellite ..	3·25 – 4	2·3 —2·35	Rhombic.
Turquoise..	6	2·6 —2·83	Reniform or Globular.
Henwoodite	4—4·5	2·67	Spherical crystalline groups

It is to be hoped that distinct crystals may be met with before long, so that there may be an opportunity of determining its true crystalline form.*

ENYSITE.

This new Mineral from St. Agnes has a hardness of 2-24, and a sp. gr. of 1·59. Its pyrognostic characters are given by Dr. Foster, and to these I would only add, that the water given off at a low temperature is neutral to test-paper, while that given off at a high temperature is strongly acid.

Exposed over oil of vitriol for three days, it loses 14·04 p.c. of its weight; heated to 150° C. it loses 18·21 p.c. more, and when strongly ignited loses 15·29 p.c. additional. This latter loss consists of Sulphuric Acid and water, but another experiment shews the total quantity of Sulphuric Acid to be 8·12 p.c.

The full composition is as under:—

Water lost over Oil of Vitriol.. ..	14·04	
Water lost at 150° C.	18·21	
Water lost at red heat	7·17	39·42
Sulphuric Acid		8·12
Silica..		3·40
Alumina		29·85
Lime..		1·35
Carbonic Acid		1·05
Chlorine		Trace
Soda..		Trace
Ferric Oxide		Trace
Oxide of Copper		16·91
		100·10

* Since reading the above papers Dr. Heddle has suggested that the "loss" may be due to zinc, fluorine, or boracic acid—neither of which would be detected by the mode of analysis adopted above. Having only ·009 grams left for analysis I have carefully examined it before the blowpipe by the very delicate methods described in "Plattner," but without finding the least trace of either. I have not been able to test for boracic acid from want of material, but I may say further that I am not aware of any test delicate enough to detect a small quantity of boracic acid in the presence of a large quantity of phosphoric acid.

This composition corresponds pretty well with the formula, $Cu\,SO_4 + Cu\,H_2\,O_2 + 3\,Al_2\,H_6\,O_6 + 12\,H_2\,O$, if the Si. be regarded as replacing Alumina, and the $Ca\,CO_3$ be excluded. The actual percentages requiaed by theory are

Water	37·16	p.c.
Sulphuric acid	9·17	,,
Oxide of copper	18·23	,,
Alumina	35·43	,,
	99·99	

If the carbonate of lime be regarded as replacing sulphate of copper the analysis comes still nearer to the numbers required by theory. The three equivalents of water supposed to be combined with the alumina would amount to 6·19 p.c., and this is pretty near the actual amount driven off at a red heat.

The Mineral is no doubt of comparatively recent formation; but as it has very marked characters, and none of the appearance of a mechanical mixture, Dr. Foster and myself have agreed to call it Enysite, after our kind friend, the late John S. Enys, F.G.S., to whom the cave belonged in which it was found.*

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* M. Pisani analysed a Mineral of somewhat similar composition (Phil. Mag., Ap., 1868), and Dr. Flight two others (Journ. Chem. Soc, 1871, Jan.) The analyses are as follows:—where C is, Pisani's mineral; A and B those of Dr. Flight; neither seem to have been named, but Pisani regarded his Mineral as a mixture of Langite and Allophane.

	A		B	C
Water lost at ord. temp. ...	15·390		13·938	
Water lost at 100°	10·413		23·864	
Water lost at 120° to 160 ...	7·333			
Water lost over 260°	5·392	38·528	6·167	43·969	38.7
Sulphuric Acid	——	6·775		2·433	4·7
Silica		6·689		7·538	6 7
Alumina		23·063		27.250	33·8
Lime		0·086		1·403	——
Carbonic Acid		——		0 528	——
Soda...		——		0·640	——
Magnesia...		0·749		6·183	——
Oxide of Copper		24·561		10 255	17·4
		100 451		100·199	101.3

V. — *Note on the occurrence of Scorodite, Pharmacosiderite and Olivenite in Greenstone at Terras Mine, St. Stephens.*

By J. H. Collins, F.G.S.

AT Terras mine there is an interesting junction of a well-marked tin-bearing elvan, whose course is about north and south, with a bed of greenstone, whose general bearing is nearly east and west.* Near the junction, a few years since, a shaft was sunk 40 fathoms deep for the purpose of working a tin lode which was believed to cross the elvan just refered to at that point. At a depth of about 10 fathoms the bed of greenstone was met with, and it continued for 6 fathoms in depth in a very hard state, but from thence to the bottom of shaft it was much softer.

The rock is one of the hardest and toughest I have ever come across. Ordinarily it is composed of a fine-grained mixture of hornblende and silica, but it contains numerous narrow cavities or partial fissures, which near the shaft in question are often studded over or lined with small crystals of the three arseniates mentioned above.†

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* This is the greenstone referred to by Mr. J. A. Phillips, in his paper recently read to the Geological Society, Vol. xxxii., Part 2, p. 175. Mr. Phillips gives its analysis as follows :—

Water	hygrometric	·20		·22
	combined	·77		·67
Silica		46·89		46·96
Phosphoric Anhydride		·31		·32
Alumina		20·46		20·53
Ferric Oxide		·2·19		2·09
Ferric Persulphide		traces		traces
Ferrous Oxide		11·15		11·18
Manganous Oxide		trace		trace
Lime		8·37		8 42
Magnesia		5.83		5·91
Potassa		trace		trace
Soda		3 87		3·80
		100·04		100 10

† My attention was first called to this locality for scorodite and pharmacosiderite in 1872, by Mr. T. Forrester Matthews, of St. Austell. The Olivenite I have discovered recently.

The scorodite is most common. It occurs sometimes in irregular rhombic pyramids or sphenoids of a pale bluish green color, but usually in stellate or divergent groups of minute feathery crystals.

The pharmacosiderite occurs in the usual cubical forms, which are of a fine deep green color, and sometimes modified at the angles.

I have only found one specimen of olivenite; this occurred in connexion with the scorodite in the usual tabular barytes-like form. I have not seen any other metallic minerals in this greenstone, but some of the cavities are marked with beautiful shining lines of some oxide of iron, which look like raised snail tracks.

The greenstone is very largely worked in a surface quarry for road material, within a furlong of this locality, but no arseniates have been found by the quarrymen. Probably such might be found if the quarry were opened in depth.

VI.—*Note on paragenetic formations of carbonate of lime and oxide of iron, and of quartz and oxide of iron, at the Mwyndy iron mines, Glamorganshire.*

By Wm. Vivian.

THESE constitute interesting objects for the microscope. The first mentioned is calc spar, having perfect rhombohedral cleavage; it is transparent, or translucent, apparently coloured topaz yellow or amber, by the intimate diffusion of ochreous iron throughout. The distribution of the colouring iron oxide through the carbonate of lime is minutely microscopic, in tangled interlacing curved lines, many of which, if not all of them, are hollow tubes not unlike maccaroni or vermicelli, but, although this form of iron oxide is distributed through the calc spar in such close masses, it does not seem to affect the cleavage planes of the latter, which separate as readily as if no ochreous iron had been present.

Another combination is of quartz and oxide of iron, existing in amorphous masses and in crystals; the quartz being transparent and the oxide of iron yellow. The mode of the distribution is somewhat different from that of the carbonate of lime and oxide of iron just described; here, the iron is disposed in flossy forms delicately suspended, as if floating in a liquid, and apparently without primary root or trunk, and yet so beautifully arranged is the iron, according to some definite law, that not a single particle seems to be accidentally misplaced.

Another combination of quartz and oxide of iron is seen here, though rarely, in which microscopic quartz crystals—perfect double pyramids—are laced externally and suspended by a peculiar yellow, not ochreous, iron, distributed in curvilinear mossy forms, and these latter are themselves studded over with very minute acicular crystals. All the specimens are best seen as opaque objects in a good light and with a low power, from 1″ to 2″ objective.

Additional note on the specimens described by Mr. Vivian.

By J. H. Collins.

In figs. 5 to 11, plate 1, I have endeavoured to represent some of the peculiarities of Mr. Vivian's specimens.

Fig. 5 represents a fragment of the colored calcite drawn natural size.

Fig. 6 is a sketch of a thin section magnified 20 times linear. It will be seen that the curved ochrey branches have no particular tendency to follow the lines of cleavage as already observed by Mr. Vivian, but they penetrate the calcite indiscriminately in all directions. The oxide of iron must therefore have existed in the original menstruum from which the calcite was deposited, and have been caught up in the act of crystallizing (just as, in a sharp frost, blades of grass are caught up in ice), the cleavage being a result of the action of natural forces at a later period.

In fig. 7 I have sketched a single branch magnified more highly, and in figs. 8 and 9 I have endeavoured to shew the tubular appearance of the branches. This is best seen by viewing the specimens in reflected light.

I have made a partial analysis of a specimen which seemed, under a low power, to be as full of the moss-like forms as it could possibly be, but I found only 1·34 p.c. of metallic iron, or say 2·17 p.c. of hydrated oxide.

In fig. 10 a piece of the quartz enclosing oxide of iron is drawn natural size. Fig. 11 is a part of the same specimen, more highly magnified, in which I have attempted to represent the interlaced structure of the contained ferruginous matter, but with only partial success, on account of its extreme delicacy in the natural specimen.

The third specimen described by Mr. Vivian is illustrated in figs. 12 and 13, but it is so delicate that the figures only very imperfectly represent it. The constant occurrence of such specimens strengthens the evidence already existing that such iron ore deposits as that at Mwyndy, like those in the lodes or cross-courses of Cornwall and Devon, are due to infiltration of ferruginous matter from the surrounding rocks into pre-existing fissures.

VII.—*Description of a new form of Blowpipe Lamp, especially suitable for travellers.*

By C. Le Neve Foster, B.A., D.Sc.

THIS Lamp is shewn half size in figs. 1 to 4. Fig. 1 is a section of the whole lamp; fig. 2 a view from above; fig. 3 shews the mode of folding the wick; and fig. 4 the tinplate cover, which serves as a stand while the lamp is in use.

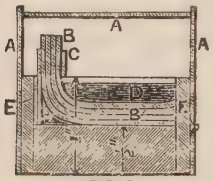


FIG. 1.

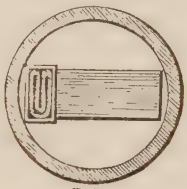
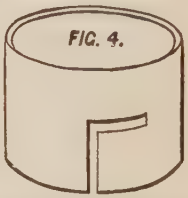


FIG. 2.

FIG. 3.



AA is the tinplate cover; EE the gas pipe forming the body of the lamp; BB is the wick which is best if of the "Freiberg" kind, broad, thin, and folded; C is the wick-holder of tinplate, soldered on to E; D is the wax or composition.

It is provided with a "bayonet" slot, which works over the little pin shewn in fig. 1, so as to keep the cover in place when it is put on over the lamp.

The body of the lamp is made from a piece of iron or lead gas pipe, 1½in. internal diameter, to one side of which the wick holder is soldered. I find that "night light" grease suits admirably —ordinary composite candles do very well.

Mr. W. Lombardi, of 4, Argyll Place, Regent Street, London, has used roughly made lamps of similar construction for the last fifteen years, using cocoa nut oil, colza oil, or tallow, and a large mouth blowpipe for soldering and melting. In using the lamp, it is well, after lighting the wick, to direct the flame over the wax or tallow for a little, so as to melt it before proceeding to use the lamp. After use, and while the wax is melted, the wick should be pulled up about ⅛ of an inch with a pair of tweezers before the wax solidifies, otherwise the wick will be too short to allow of trimming before the next operation.

VIII.—*Historical Notes on the Occurrence of Gold in the South of Scotland.*

By Patrick Dudgeon, F.R.S.E. & F.S.A. Scot.

FROM a very early period gold has been found and worked for in Scotland. We have records dating as far back as the time of James I., in which grants were made to different parties to search and mine for this metal; and no doubt it was obtained at a much earlier period. The gold ornaments found in Scotland, with other relics of pre-historic times, were doubtless manufactured from native gold. Several localities are mentioned in these old grants where gold was to be searched for; but by far the most important district is that generally mentioned as Crawford Moor, which appears to include the range of hills at Wanlockhead and Leadhills, and the streams which fall into the Clyde on the one side, and those which reach the Nith and Annan on the other. The head water of the Tweed, where gold has been found to a limited extent, appears to have been included in this district.

The Crawford Moor district appears to have yielded a very considerable quantity of gold. It is stated that as much as £100,000 sterling was obtained in three years' washing, and various authorities mention that nuggets varying from 2 gr. 30 oz. have been found.

The usual method employed to obtain gold was by washing the alluvium in the valleys, and the gravel, &c., from the streams. In the Statistical Account of Scotland, by Sir John Sinclair, 1792, parish of Crawford, Lanarkshire, it is mentioned that on the lands of Abington vestiges of the gold workings are still seen. Professor Geikie, director of the Geological Survey, has informed me that, during the recent survey of the district, he and Mr. R. L. Jack, one of the officers of his staff, noticed the remains of what are undoubtedly ancient gold-washing places; these may be seen on Windgate Burn, Short Cleuch Water, and on the banks of the Glengonar Water, near Abington, in Lanarkshire; and on Mennock Water, half-way between Whitestone Cleuch and Wee Black Carlie, in Dumfriesshire.

The earliest official notice I have seen regarding gold in Scotland is a grant made by King David I., A.D. 1125, to the Church of the

Holy Trinity of Dunfermline, of his tenth of all the gold found in Fife and Fothrif.[1] There is also an Act of James I., A.D., 1424, which states, 'Gif ony myne of gold or siluer be fūdyn in ony lordes 'landes of y^e^ realme, and it be prwyt th^t^ thre half-pēnys of siluer 'may be fynit owt of y^e^ punde of leid, the lordes of parlimēt con-'sentes th^t^ sik myne be y^e^ kinges as is vsuale in vthir realmys.'[2] This is interesting, as showing that at that early period the somewhat complicated process of separating silver from lead was known.[3]

Considerable attention appears to have been directed to the gold in Scotland in the time of James IV. It is stated in Chalmers's *Caledonia* that 'James IV., who was a great dabbler in alchemy, 'appears to have wrought some (gold) mines in Crawford Moor. In 'the Treasurer's Accounts of 1511, 12, and 13, there are a number 'of payments to Sir James Pettigrew, and the men who were 'employed under him in working the mines of Crawford Moor.' In the preface of a French account of the reign of James V., a translation of which was published in London, 1710, it is stated that 'in 'the king's reign (James V.) gold mines were found in Crawford Moor by the Germans, which afforded the king great sums. The 'Scots did separate the gold from sand by washing;' and again, 'In James V^th's^ time 300 men were employed for several summers in 'washing gold, of which they got above £100,000 English money.' The search for gold seems to have been vigorously prosecuted from time to time during the reign of James VI., and grants to various parties were made 'to search and try for gold,' the conditions in the grants generally being, that all gold found was to be sent to the mint in Edinburgh to be coined, one-tenth of the coinage to be retained for the Crown, and nine-tenths to be delivered to the finder. These grants generally applied to the whole of Scotland, but little appears to have been done in other localities, and the search, excepting in the Crawford Moor district, never appears to have been remunerative.

1 *Registrum de Dunfermelyn*, Bannatyne Club, p. 16. No. xxviii.

2 Thomson's *Acts of the Scottish Parliament*, vol. ii. p. 5.

3 As no silver halfpenny of the reign of James I. is known to exist, the weight of this coin is somewhat uncertain. The groat of this reign may be taken to weigh about 36 grains, the weight of a half-penny would therefore be about 4½ grains, so three silver half-pennies to the pound of lead would represent 15½ grains, equivalent to about 62 ounces to the ton of lead. No Scotch lead approaches to anything like this in the quantity of silver it contains.

An Act of the Privy Council, in favour of Steven Atkinson, 11th June, 1616, says,—

'Whereas Stevin Aitkinsoun, Englishman, has vndertane and 'promiest to the Kingis most sacred Majestie, that vpon his awne 'propper chairges and expensses he sall make ane new searche, 'tryall, and discouerie of the mynes, seames, and minerallis in 'Crawfurde Mure, with Saxeere, the Calumeere, and the Salyneere 'stanes, and of all mettall of gold and silver, etc. . . . grantis full 'power and commission by these presentes to the said Stevin, and 'his seruandis and suche vtheris as he sall adjoyne vnto him, als-'weell countreymen as strangeris, during his lyfetyme to searche, 'seik, worke, dig, try, discouer, and find oute all suche seames and 'mynes of gold and silver. . . . Provyding alwayes, like as it is 'heirby expreslie ordanit, commandit, and declairit, that the said 'Stevin sall bring in to his Majesties Coneziehouse at Edinburgh 'the whole gold and silver that sall be descouerit,' to be coined, one-tenth part to be His Majesty's due, and nine-tenths of the coined money to be delivered to 'the said Stevin.'

A grant of James VI., in 1593, narrates that the gold, silver, lead, &c., mines in Crawford Moor and Glengonar were given to Thomas Foullis, goldsmith, in Edinburgh, for twenty-one years, in consideration of the great sums due to him 'and his dearest spouse.'

In 1621 the gold mines 'within the boundis of Crawfurde-mure, 'Friersmure, and Crawfurde-johne, in the ouerwaird of Cliddisdale,' was let to 'Johnne Hyndlie, phisicioun,' on the same terms as to Steven Atkinson.

Atkinson, in his *Discouverie and Historie of the Gold Mynes in Scotland*, 1619, mentions that a Mr. George Bowes, an Englishman, procured a commission to work the gold mines in Scotland (*temp.* James VI.); that at Winlocke Head he discovered 'a small vaine of gold, which had much small gold upon it.' He swore his workmen to secrecy, and after working the vein for some time carried off to England a considerable quantity of gold. Before leaving he caused the shaft to be closed up and concealed. This vein appears to have been looked for, and is alluded to by several other parties about this time; but it was never re-found. Bowes also worked at 'Long-clough-brayes or head, up the great hill,' where he 'discovered a 'small string thereof. This vaine had the sapperstone plentiful in 'it, which sometimes held naturall gold, a little, not much.' Here

Mr. Bowes erected a stamping-mill, and by this means 'used to gett 'small mealy gold.'

There is in the Cottonian Collection in the British Museum, an interesting MS.,[1] containing a great deal of information respecting the gold-fields of Crawford Moor. The writer appears to have been employed by some one to report on the gold-bearing district in this part of Scotland. The MS. has no date, and unfortunately it has been a good deal damaged by fire, and consequently the reading is rather fragmentary; in quoting from it, I have indicated the illegible parts by periods, and the probable continuations of words and sentences are closed in brackets. The MS. says, 'I have been 'informed in Kinge James the fou[rth's time] Scottishmen did 'begin to washe Golde, and in King Ja[mes] . . . somers there was 'three hundred psons w^{ch} did mainta[in themselves by washing] 'golde; but for theis 40 last yeres there hath ben little . . . fore-'said eightie yeres manie Gills, waters, and valleis have [yielded] 'therein of greater value than an hundred thousand pounds y[early] '. . . people workinge for Golde, no vains of Gold have been 'knowne to be f[ound].' . . . The MS. then goes on to narrate numerous localities where gold has been found, which will be referred to further on, and gives a lot of the empirical jargon of the period, as to the indications where the different metallic ores—including gold, silver, tin, lead, copper, and iron—are to be found; it then proceeds, 'bie report of sundrie workmen, some whereof 'affirme that at Pontahields . . . Winlock Water, and in sundrie 'other places, they have founde golde in bignes of cherristones, and 'some greater peeces, lyinge between two rocks in a yallowe . . . 'blewishe mother or leeder' 'bie testemonie and voluntarie othes of 'such as have founde peeces of golde, and have seene founde bie 'others, one peece of 30 ounces, and some of greater waight which 'were flat and mixed wth spar, and some wth keele, and some wth 'Brimstone, and the Lorde of Markestone did show . . . three 'quarters of an ounce, and some lesser [peeces] . . . those peeces 'were torne bie the force of water . . . of y^{e} waters since that time 'wherebie I doe [think keele and] Brimstone are leaders to y^{e} vaines 'of golde.' The writer of the MS. goes on to remark upon the ignorance of the gold-washers of the district in neglecting the indications which he perceived of metallic ore; and further says that

1 Otho, E. x. f. 12.

many trials for gold had been made on the side of the hills, and that he having 'made two daies triall in y^e^ toppes and sides of y^e^ hills, did likewise finde noe golde.' The MS. concludes with the remark 'that there hath ben . . . plentie of golde gotten in y^e^ waters of 'the said cloughes and Gillies 80 fad[oms] above the foresaid waters 'in y^e^ valleis, w^ch^ golde being ponderous . . . must bie common 'reason descend: so as consequentlie, wheras some peeces of [gold] 'of above 30 ounces weight have been founde in the said Gilles, the 'same must . . . growe there aboute or bie violent waters be dryven 'out of higher places wher they did growe w^th^ in y^e^ circumference 'of those places where the Golde is founde.'

There is sufficient evidence to prove that gold in this district was found in no inconsiderable quantity. The writer of the MS. here referred to appears merely to have taken the evidence of the gold-washers and miners in the district, as to the quantity of gold found, and beyond the two days' search in the hill-side, to which he alludes, seems not to have done anything in examining the ground personally. In a paper contributed to the Edinburgh Geological Society, Dr. Lauder Lindsay says that some centuries ago upwards of half a million of gold was obtained by a systematic method of working, but he does not give the data on which he rests this assertion. In the French book of the life of James V., alluded to above, it is stated 'great plenty (of gold) has been got in Langholm Water, 14 'miles from Leadhill House, in Crawford Moor, and in Meggat 'Water, 12 miles, and over Phinland 16 miles from that house, and 'in many other places where peices of gold 30 ounces weight havo 'been found.' Atkinson, in his work above referred to, says: In James VI.'s reign, one Cornelius, a lapidary in London, and five others, obtained a grant to work all the gold and silver throughout the kingdom of Scotland; they commenced with a capital of £5000 Scots, at Crawford Moor, and in thirty days they sent to the mint in Edinburgh eight pounds of gold, worth £450 sterling. He also mentions that Sir Beves Bulmer, who obtained a grant to work the gold mines in Scotland in 1578-92, obtained gold, a small quantity, in 'Mannock Moore, in Nidsdale;' at 'Winlocke Water, on Robbart Moor, he gott sometimes a pretty quantity together;' at 'Fryer Moore, in Glangonner Water, he gott there reasonable good store;' 'upon Short Clough Water, on Crayford Moore, he often found good 'store thereof; and he gott as much gold there as would maintaine

'iij times so manie men as he did keepe, royally.' Atkinson also states, regarding Mr. George Bowes's workings, that 'upon Glen-'gabere Water in Inderland, within the Forrest of Atrick, Mr. 'Bowes gott the greatest gold, the like to it in no other place before 'of Scotland; 'and he had there sometimes great gold like Indian 'wheate, or pearle, and black-eyed like to beans.' In the Cottonian MS. above referred to, it is stated 'gold hath ben gotten bie 'washinge bie y^e^ L. of Markes[ton] . . . distant from Leadhill 'Howse, in Crawford Moore, 28 myles, and [gold] hath ben gotten 'in Langham Water, 14 miles, and Megget Water . . . Phinlande, '16 miles distant from Leadhill Howse, and in many other [places] 'bie testimonie of sundrie reputed honeste; w^th^ golde to have been 'gotten . . . so far distant one from another, doth showe there are 'either manie se[ames] . . . y^e^ golde so founde is generallie dis-'persed, and doth but ly in y^e^ supfice[al] not in the solid and knit 'vaines.'

Besides the localities referred to above, where gold has been found, in a memorandum by Robt. Seton, *temp.* James V., it is stated gold has been found at Newtoun in Angén (?) Cartburn in Annandale, Solway sands, near the new toun of Annand;[1] Glen naip,[2] betwixt Carrick and Galloway; Galloway, in the barony of Tar-eagles, and in a hill called Coloshere Hill; in the Hill of Skrill,[3] '*mucho oro y grandes pedacos.*'

In an account of the Metals and Minerals found in Scotland, given to Sir R. Sibbald by Colonel Borthwick (*temp.* James V.), many of the localities mentioned above are given; the only locality not already noticed is Kersop, upon Yarrow Water, in Philiphaugh ground

Various attempts have been made more recently to work the gold in this district, but it has never been found in 'paying quantities,' and any idea of now working for it profitably appears to be quite abandoned. Gold however, in small quantities, can always be found in the sand of various streams of the district and in the older alluvium. Some of the miners at Wanlockhead and Leadhills wash for it occasionally, and can always procure it for any one desiring to obtain specimens. The gold obtained in this way costs the purchaser very much above its intrinsic value; the miner who collects it

1 Annan (?), 2 Glen-app (?),

3 The Screel of Bengairn, near Kirdcudbright (?),

charges so much a day for washing, and the gold in many cases will be found to cost nearly one shilling per grain.

Some years since the Duchess of Buccleuch had three or four ounces collected, and about the same quantity was recently collected for the Countess of Hopetoun, and made into ornaments. Sir T. E. Colebrooke, Bart., has also obtained from two to three ounces. Mr. Clark, of Speddoch, and others connected with the district, have from time to time obtained smaller quantities. All the gold recently collected has been got from the streams in small grains. The largest piece I have seen from this district is a small nugget, weighing 209 grains, found seventy to eighty years ago, which is in the possession of the Earl of Hopetown. The late Dr. Martin, of Leadhills, had in his possession a nugget weighing about one and a half ounces, which was found many years since near Wanlockhead.

It is only very rarely that gold has been found in this district in the matrix, *i.e.* in vein-quartz, and then it has only been obtained in detached pieces, and never *in situ*. The auriferous vein of quartz mentioned in Atkinson's *Discouverie and Historie* has never been refound, though doubtless auriferous veins must exist somewhere in the locality. A very interesting specimen of auriferous quartz was found by a miner at Wanlockhead, in 1872. The man unfortunately broke the specimen into a number of pieces, and sold them to various individuals in the district. With the assistance of Mr. Clark, of Speddoch, I obtained the loan of all the pieces from their respective owners, and joined them together; only a few small chips were found wanting. The restored mass measures about $4'' \times 3'' \times 2\frac{1}{2}''$, veins of gold run through the quartz in the direction of its greatest diameter. *

The only other specimen of auriferous quartz found in this locality, which I know of, was obtained by the late Professor Traill, about the beginning of the century, and is now placed in the mineralogical collection in the Museum of Science and Art, Edinburgh.

The gold of the south of Scotland, like all Scotch gold, contains a considerable percentage of silver. I am indebted to Professor

* This specimen was found by Andrew Gemmell, who wrote to Dr. W. Lander Lindsay as follows respecting it, on the 10th February, 1875:—"About the lump of gold quartz that I found in 1872. . . . I have no bits of quartz of the same lump now. I never knew of any being found here as large. It would be about 10 lbs. weight, and mixed with gold all through, less or more. A number of gentlemen got a piece of it, and one gentleman has got a number of the pieces from the other gentlemen and is going to take a model of it."

Church for the following analysis of some gold sent him from this locality:—

Gold	86·60	per cent.
Silver	12·39	,,
Iron	·35	,,
Other substances, and loss,	·66	,,
	100·00	